THE

YOUNG MECHANIC.

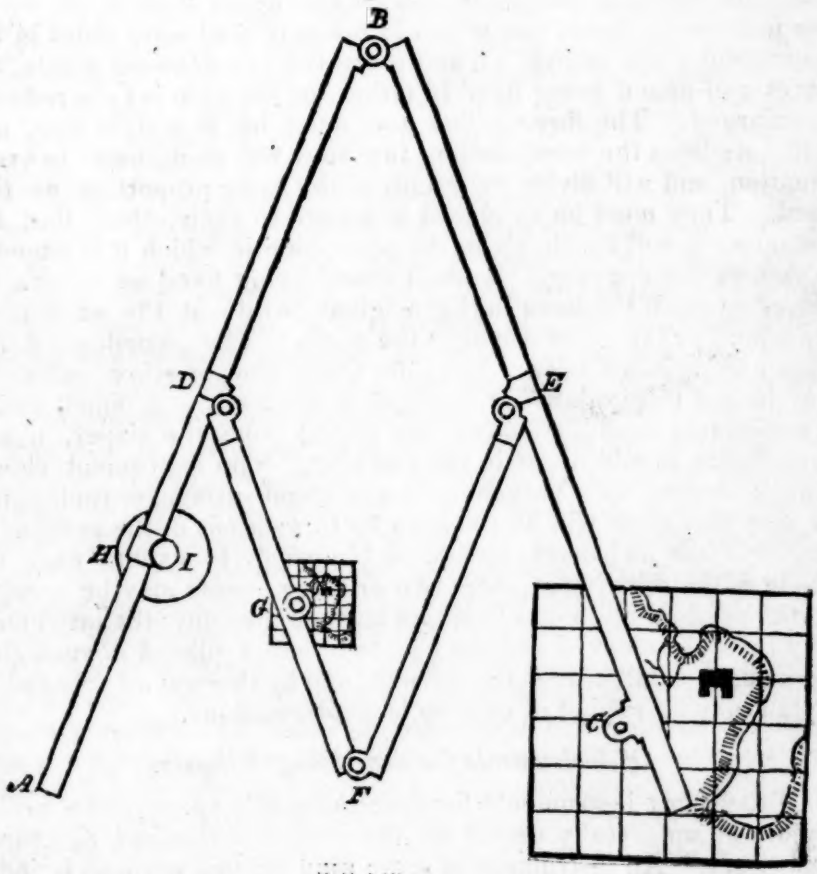
VOL. I. OCTOBER, 1832. No. X.

OBSERVATIONS ON DRAWING INSTRUMENTS.

[Continued from p. 132]

THE PANTAGRAPH.

Fig. 1.



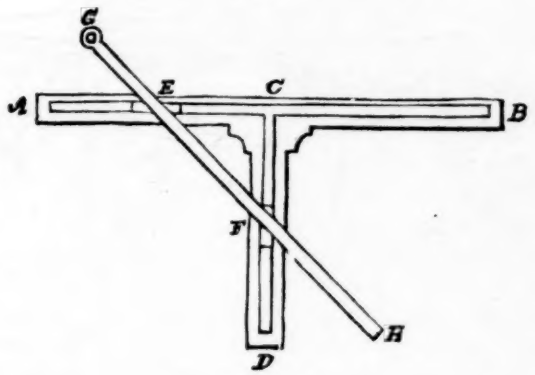
NEXT to the proportional and triangular compasses the *pantagraph* or *pantographer* is probably the best instrument by which the labor of copying a drawing is lessened; indeed by many it is preferred to all others. By it a drawing may be reduced or enlarged, or made to the same scale at pleasure, giving the lines with great exactness, however crooked and complex, which renders it very valuable, as there is no other correct method of obtaining copies of such lines. It is not known for certainty who was the inventor, but the earliest account which is found of it is in a book, published by *Scheiner* a Jesuit, in the beginning of the 17th century. The geometrical principles will be easily understood on inspection by every mathematician. Fig. 1. AB and BC are two thin rulers of wood, brass or steel, joined at B by a double pivot; DF, EF, are two shorter rulers united at F and attached to the long bar, by joints DE. The proportion of these rulers is not important but in the construction of the instrument; the four taken together must always form a parrallelogram, then EF in all positions will always remain parallel to AB. A small castor or wheel is fixed under each joint upon which the instrument rests, and which allows it to traverse freely in every direction. H is a circular leaden or brass weight, having on its under side, three small points for entering the paper, and on the upper a pivot on which the instrument turns, and which is the only stationary point in the instrument while in use. C and G are the two drawing points, the tracer and pencil being fixed in either, as the plan is to be reduced or enlarged. The three points IGC must be in a right line, and it follows from the construction, that they will continue so in every situation, and will divide its length in the same proportion as first fixed. They must be so placed in regard to each other, that the distance C G will divide C I in the proportion in which it is intended to reduce the drawing. A blunt tracer being fixed at C, can be passed over all the lines in the original, while at the same time, the pencil or ink point G makes the copy. The pencil point has generally attached to it a cup, into which shot or other substance may be put to regulate the strength of the mark. A small string is sometimes used for lifting the pencil from the paper, if any irregularity should occur in the marking. The instrument should always be used on a very smooth and plane surface, or their points by the flexibility will be liable to be thrown out of the perpendicular. If the instrument should be too small to extend over the whole of the drawing at once, two or three points may be marked in the original and corresponding ones on the copy; the instrument may then be removed and the sheets of paper placed in such situations as to admit of copying the rest, and by this way of proceeding a plan may be copied of ever so large dimensions.

Of Instruments for describing Ellipses.

Of the many instruments for describing this curve none probably are so universally useful as the common *trammel* or elliptic compasses. An instrument of some kind for this purpose is indis-

pensably necessary to the artist, if he draws in perspective or projection. The trammel has many defects which renders it rather inconvenient at times. Fig. 2 consists of two pieces of

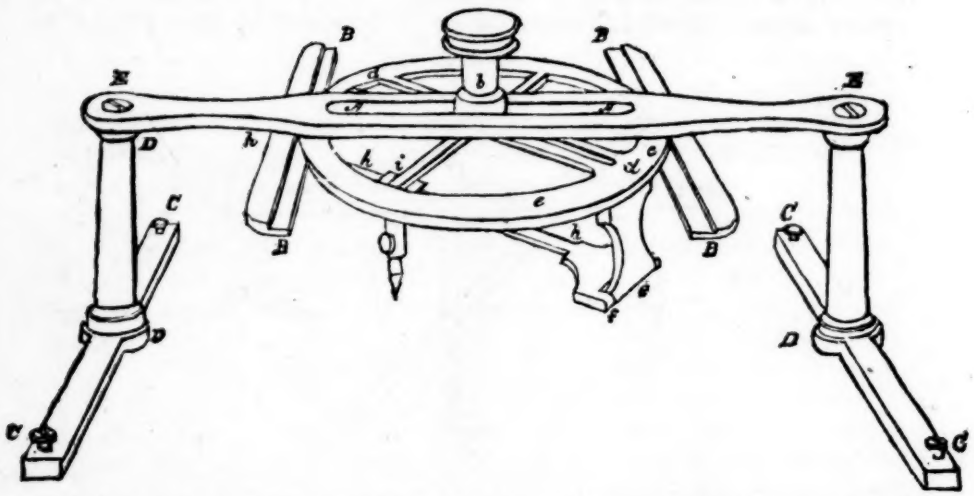
Fig. 2.



brass AB, CD, at right angles to each other in which are cut two dovetail grooves to receive two small sliders E F, which are accurately ground in them, and move freely without any shake or looseness. A small hole is made in the centre of each piece to receive the ends of the pins which project downwards from the sliding sockets on a small beam of brass or steel GH. In the extremety G of this beam is fixed a small tube containing the pencil or ink point. The cross has four small points on the under side to confine it to the paper, and suitable marks on the ends to set it over the centre of the intended ellipse. The rule for setting the point is to make EG equal to half the transverse diameter, and FG to half the conjugate of the ellipse, and by turning the beam the two slides will move in their respective grooves and an ellipse be produced. The instrument in its present form cannot be used for drawing small ellipses, or very narrow ones, as the drawing point will interfere with the arms of the cross and the two centres cannot be brought sufficiently near each other. For these reasons the instrument is totally inapplicable to small ellipses.

Fig. 3 is an instrument called *Elipsafex*, by which ellipses can be drawn on paper with great facility and exactness, by merely making a right line for the transverse axis, and laying the centre of the instrument over this. If the centre screw is placed in its greatest, or indeed any eccentricity, and the pencil immediately under it, the pencil on turning the wheel will be found to describe a right line. If on the contrary the centre screw is placed on the centre of the wheel, the pencil will describe a circle which may be diminished down to a point without making any centre mark, and hence the instrument is capable of describing every proportion of an ellipse between a circle and right line. Fig. 3 is a general view of the instrument, consisting principally of a frame, wheel, and arm carrying the pencil tracer or pen. EE is a horizontal beam, having a groove AA cut in it, and being fixed to the tops of the supports, ED, ED. BB, BB, are guides, each consisting of a brass bar and a steel plate attached to the horizontal bar EE.

Fig. 3.



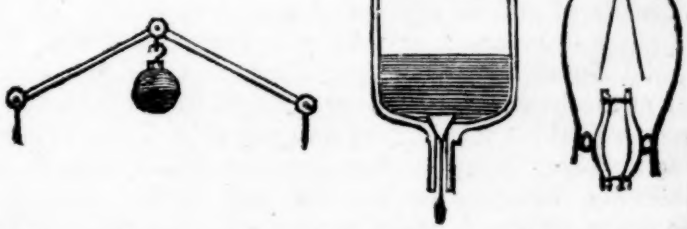
The straight edges BB, BB, of the steel plates should be parrellel to the feet CC, CC, or to the table. *c* is a wheel grooved on the edge so as to fit and slide upon the steel plates BB, BB, and to move freely and exactly thereon, so that the centre of the wheel may be compelled to describe a straight line parallel to the drawing board. The arms of the wheel are at right angles to each other, in one of which is a groove *dd*, in which is inserted a slide made to fit the groove exactly and to move freely therein. *b* is a screw with a milled head made to fit the groove AA, and tapped into the slide so as to fasten it in any part of the groove AA. A vertical piece of brass *ee*, to which is attached the arm *ehh* by a joint, projects downwards from the wheel. The arm has a slider *i*, with a tube or case connected to it, which carries the pencil or tracer, and which by means of the clamp screw may be fixed on any part of the arms. In adjusting the instrument the two grooves AA in the beam EE, and *dd* in the wheel, should be brought underneath each other so as to be in one straight line; then make the distance of the tracer from the centre of the instrument equal to the semi-conjugate axis, and move the screw *b* so that the distance between the point of the tracer and centre of the screw shall equal the semi-transverse axis. By turning round the wheel the screw *b* moves backwards and forwards in the groove AA by the eccentricity of the circle, and the ellipse is described. Many other instruments for the same purpose have been invented by Farey, Clement and others, which are very complex and costly, for a description of which the student is referred to *The Transactions of the Society of Arts.*

MEMOIR OF A MECHANIC.

[Continued from page 137.]

In June, 1820, I left London for St. Petersburg, in Russia; at which place I arrived in eighteen days. I was sent out with apparatus for the production of gas from oil, for the purpose of illumination. We left the ship at Cronstadt, and proceeded to the city in a steam boat. It was about eight o'clock in the evening when we came in sight of St. Petersburg. The sun was rather low. His rays had a fine effect on the bright steeples, and splended domes of the public buildings, all shining with a metallic lustre, so that, for the distance of five or six miles we had as grand a sight as I ever witnessed. It was light enough to see to do ordinary work out of doors, all night for several weeks after I arrived. I remained three years in this city, and could say much about the place and the people, but must confine myself chiefly to mechanical operations. It is astonishing to see the variety of work a carpenter there will do with his axe only; it answers for the saw, hammer, rabbit plane, shave, and in some cases for the chisel. At his meals, he cuts his black bread with it. The fore plane which they use, has four handles. It takes two men to work with it. They sit on a pile of boards planing that which is uppermost; one man pushing while the other is pulling the plane. The joiner uses a saw in a frame, somewhat like those used by the wood sawyers in Boston. The masons build their walls very thick. Their stages are ascended by inclined planes, instead of ladders, so broad that one might drive a carriage up them with ease. The mortar is carried by two men on a kind of hand barrow. They walk up these gentle slopes very leisurely. The bricks are carried by one man. He takes a piece of board two feet long, with four projecting pins, or arms, two of which rests on his shoulders, while the board hangs down his back; the other two pins are for the bricks to rest upon. He carries about sixteen bricks at a time. The fronts of the houses are white-washed, and their tops covered with sheet iron, and painted.

Fig. 1. Fig. 2. Fig. 3.



Lord Bacon observes, that when we travel into foreign countries, we should not adopt every new thing we see, but now and then prick in a flower. Following his advice, I will describe three things which appear to be useful, and peculiar to this place. At least I have not seen them anywhere else.

Fig. 1 represents a contrivance for shutting doors. The power is applied in the same manner as in our modern printing presses. There is a pin at each end of the apparatus. One pin is fitted to and turns in a socket attached to the frame, and the other fitted to a similar one on the door. In opening the door the pins are brought nearer together, and the weight in the centre is raised. The door is shut by this weight straightening the bars and spreading the pins further apart. Some of these articles are made of iron and black, others are of brass and kept bright. They are extensively used. Fig. 2 is a cistern for water, with a valve in the bottom, which is much used for washing the face and hands. By raising the valve the water is let down in small quantities, and as it is used passes off by means of a sink placed underneath. The advantages of this method are, that persons do not wash in the same water with others, nor use it more than once themselves, which is not only more conducive to health, but makes less water necessary than the washing in a common bowl. These cisterns are made of various forms and sizes. Some of them have a dozen or more pipes, each furnished with a valve, so that many persons may wash at the same time; the large ones are made in a circular form, and placed in the middle of a room, but the small ones are hung against the wall. In Fig. 3 is represented a spring bow or arch. This is used with the horse-collar, for the horse that is placed in the shafts. Other horses do not have them. It was a long time before I could see any other use for this contrivance, than to cause the horse to hold up his head, and to keep him from stumbling by the bridle being hooked to the top of this arch. I was informed afterwards by an intelligent man, that the spring being connected with the collar, prevented the shoulder of the animal from chafing by continually easing the collar off, and suffering the air to pass between that and the shoulder of the horse.

Generally speaking the Russian workmen do very well. As there has been great encouragement given to strangers, many have settled among them who have improved their manners. Their manufactories of iron, and of goods from hemp and flax, have been long celebrated. They have also carried the manufactories of paper, cotton, silk, and glass, to considerable perfection. Granite is much used in their public works, for foundations of buildings, lining the canals and rivers, and for side walks. Some of the columns made of granite are very large, and highly polished. I took the pains to measure one of the columns intended for a new church, and found it fifty six feet long, and six feet six inches diameter at the base. They were brought from Finland. Two of them were a load for a ship, one on each side of the masts to ballance each other. They were rolled from the deck to the vicinity of the intended building on timbers nine inches square, placed but little distance apart, which were completely crushed to splinters. The rolling was performed by two ropes; one end of each was made fast some distance ahead, to stakes driven in the ground. They were passed under the column up the back side, and over

the top. The other end of each rope was wound round a separate capstan. Each capstan had four long levers, with from ten to twenty men at each lever. These columns were placed in a temporary building for polishing. I also visited the foundry where the bases and capitals were made. They were of brass of the Corinthian order, and highly polished and gilt. The square plinth for the bottom, was about nine feet on each side and one foot thick. Several women and children were polishing these with pumice stone. The torus, a round bead belonging to the base was turning in the lathe. The man had a very strong tool for this purpose. A steam engine, with a man to attend it, was employed entirely on the work. The capitals, with their leaves and volutes, had a very splendid appearance.

The building in which I was engaged in putting up the gas works, was for transacting the business of the Russian army. It was built in the form of a crescent, having a large arch in the centre. It was situated opposite the imperial palace. The area between these buildings was used as a parade ground for the soldiers every morning. In this building were several departments, with a general at the head of each, some of whom employed over two hundred clerks. The library was very extensive, in the centre of which we put up a splendid chandelier, which cost four hundred pounds sterling in England. It had three hundred and sixty jets of gas issuing from a circle of brass seven feet in diameter, above which were four eagles lit with gas. There was also a great quantity of richly cut glass about it. In this building I saw lithographic printing for the first time; copperplate and letter press printing were carried on here, and a very extensive establishment for the manufacture of mathematical instruments, all belonging to the government; likewise a drawing school, consisting of about two hundred young officers.

The Academy of Arts is open to the public once in three years. I had the pleasure to spend several hours in examining some of the specimens of painting, sculpture, &c. in the rooms and corridors, but they were so numerous as to require months instead of hours to examine them properly; the corridors alone are said to extend more than a mile in length. Although this building is devoted chiefly to the fine arts, there are many specimens of mechanical skill. I noticed a model of the machine, on which a large block of granite weighing upwards of nine hundred tons, was removed several miles. Peter the great is said to have stood on this rock, giving command to his army, when he subdued the Fins. The empress Catherine ordered it to be removed to the city, for a foundation, on which is placed a bronze statue of that Monarch on horse back. Many ineffectual attempts were made at its removal; but it was easily performed afterwards by introducing cannon balls for rollers between bars of iron.

The most splendid specimens of art that I remember to have seen, were in the emperor's Hermitage, which is attached to the Imperial palace, and is a place of retreat from the busy scenes of

the court. In this building are many splendid rooms, the walls of which are hung with the most costly paintings, by the first artists in every country, that could be procured by money or otherwise; several delicate specimens of sculpture, and models of architecture; with a variety of curious articles made of gold, silver, and ivory; in fact, nearly every material is here to be found fashioned into something either useful or amusing. The splendid jewels belonging to the emperor are kept here, and a great variety of gold and silver coins and medals. Some of them are very ancient. There is also a cabinet of minerals, and a collection of rare books. One work appeared to consist of about eighty thick folio volumes, and to be placed there more for show than any thing else. These rooms form a square; in the interior is the winter garden, kept warm and comfortable. There (let it be ever so cold and dreary without,) is to be found thriving plants and singing birds. Directly over this is the summer garden on the top of the building, and to complete the variety there is a small theatre, with seats in a circular form, which I thought would be a good model for a lecture room. Among the specimens of the mechanic arts, were two large vessels, seven feet in diameter, one of richly cut class, and very massive; the other was of jasper, and about the same size and pattern; they were wrought in the country, and presented to the emperor as rare specimens of skill.

There are other palaces in St. Petersburg, and several in the country within thirty miles of the city. Some of them have very fine gardens laid out with great taste, the walks of which are very pleasant; for nature and art have been used to the utmost to make them so. Many marble statues are placed in the gardens, and appear to have been brought from the ruins of ancient cities. The gardens are frequently enlivened with bands of music. The summer palace at Tsascocella was the most popular, having been the favorite retreat of Alexander. In these gardens are many curiosities, among which is a complete chinese village, with cottages, bridges, and temples; but the thing that pleased me best, was a spring of water with its embellishments. It is situated in a valley, well shaded with tall trees. The approach to it is rather gloomy; but when you reach the spot an open space appears. The spring is on one side; and on the opposite side are seats placed in a semicircular form, where you may rest yourself. The water issues from a broken pitcher, which appears to have just fallen from a young lady's hand; which is a remarkably delicate piece of work in bronze. It consists first of a pedestal, on which a beautiful young female is reclining, supporting herself with the left arm. In her right hand is the handle of the pitcher. The pitcher itself lies on the pedestal, and overhangs the front edge enough to prevent the stream of water from touching its base. Her eyes are fixed on the pitcher, and she appears to look so earnest, and so composed that if she could speak, I should expect her to say, coolly, It is done, and cannot be helped.

It will be readily imagined how my leisure time was spent while

residing in this city. It was spent in studying the Russian language, drawing, and mechanical amusements in winter time; and in summer, visiting places of note, and observing the manners and customs of the inhabitants.

(To be concluded in our next.)

BOSTON MECHANICS' INSTITUTION.

THIS SOCIETY was formed by the exertion of a small number of practical mechanics, near the close of the year 1826. Desirous of obtaining for themselves, and the citizens generally, a more perfect acquaintance with the common principles of science, particularly those immediately connected with the useful arts, they united in an association for the attainment of this object in the most direct and efficient mode within their reach. It was at once perceived that instruction could be more easily and generally diffused by means of lectures than in any other way. Arrangements were therefore made for obtaining, immediately, a few lectures on some branches of mechanical philosophy and chymistry, to the members of the institution, to which persons of all professions were elligible. On the public announcement of this design a great number of individuals joined the institution, and it was opened with an address by the Corresponding Secretary on the 7th of February, 1827. The subsequent lectures of the season were attended by 450 members, and 77 minors.

This encouraged the Board of Managers, to whose care the government of the institution was committed, to attempt the collection of an apparatus for performing the experiments necessary to a clear illustration of the subjects of physical science. For this purpose a subscription was opened, and in a short time about $1,150 was subscribed, principally by wealthy citizens, in sums of from 10 to $200.

The collection of apparatus thus commenced has since been continued to the full extent of the means of the institution, and consists, at present, of a beautiful working model of the steam engine; a large air pump, and all the necessary pneumatic apparatus; complete and well excuted models of all the mechanical powers; a complete model of a water wheel, and models of a variety of hydrodynamic apparatus; a carriage and several models of railways; models of various other apparatus capable of illustrating important elementary truths in mechanics, and the useful arts.

In the summer of 1827, an act of incorporation was obtained from the government of the commonwealth, and the lectures of the following season were delivered at the hall of the Athenæum, to 544 members. As a greater number of persons than this could not be accommodated with seats in the hall, the Managers were unable to issue any tickets for the admission of minors. Arrangements were made, however, in the summer of 1828, for the repeti-

tion of the lectures, which should be delivered in the succeeding winter, to a class of minors, and the instruction was thus extended to 240 young persons, principally apprentices and students preparing for active life.

The lectures were repeated two seasons; since which time that measure has been unnecessary, owing to the number of kindred societies that have been established since the formation of this. The Mechanics' Institution still maintains an elevated rank. The Managers have made arrangements for the admission of minors, and also for that of Ladies, the coming season. The lectures will be delivered at the Temple Lecture Room.

INDIAN METHODS OF WORKING IRON AND STEEL.

From the Transactions of the Society of Arts.

ON THE DAMASCUS GUN BARRELS.

The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, *are manufactured of iron hoops, obtained from European casks, mostly British.* The more these hoops *are corroded with rust*, they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one third of an inch thick; it is then doubled up in three or more lengths, and again welded and drawn out as before; and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation, brings the *wire* or *vein* outwards upon the strap. The barrel is then forged in the usual way, but much more jumping* is used, than in the English method, in order to render the twist finer. The most careful workmen always make a practice of covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal. When the barrel is completed, the twist is raised by laying the barrel, from one to five days, either in vinegar, or a solution of the sulphate of

* Or upsetting endways, by striking the barrel against the side of the anvil while it is of a welding heat.

iron, until the twist is raised; this process is called the *wire twist*.

To produce the *curl*, the bars or straps are drawn into bars about three quarters of an inch square, and twisted, some to the right and others to the left hand; one of each sort is then welded together, doubled up and drawn out, as before described; and according to the skill and experience of the workman, any intricacy of twist is produced, by thus drawing out, doubling and twisting.

Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. A native artist never works with pit coal, under any consideration: charcoal from light wood forms his only fuel.

ON THE DAMASCUS SWORD BLADES.

In making the sword blades, there are several methods used; some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer.* These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted and re forged several times; *the twist is brought out* in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

Some sword-blades are forged out of two *broad* plates of steel thus prepared, with a narrow plate of good iron welded between them, toward the back, and thus leaving *solid steel for the edge*, to a considerable depth.

Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give them strength and toughness.

Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

THE HARDENING COMPOSITION.

The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, heated to a moderate red heat; and just as the red was changing to a black heat, quenched in spring-water.

From the information of the workman, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *fonlode hind*, or Indian steel, of which there are great quantities and but little or no demand for it. The *Damasaque* (or *joar*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solutions.

* The soldering steel or iron with cast-iron and borax, and welding afterwards thus, seems to be an Eastern practice.

REVIEW OF 'HINTS ON THE ECONOMY OF HEAT.'

MESSRS. EDITORS—Your correspondent Philo in the last Magazine, has given some 'hints,' to which he appears to attach considerable importance; but, not judging from the same criterion which he has apparently adopted, I must acknowledge, that the great benefit resulting from such a plan as he proposes, is beyond my comprehension. I really cannot believe, that Philo wrote his communication with any idea of its practicability; if he did I can only say, that it is the *grandest* scheme, with the *least* advantage, which he could possibly have imagined; in the prosecution of his plan, he has sacrificed comfort, convenience, and usefulness without mercy. I would inquire, what degree of heat the air would possess after travelling through miles of tubes placed under ground? or in what manner is a house to be warmed, if the main conducting tube of that house should by any accident be injured?

Not to extend this critique to an unlimited length, I must pass over without comment, many of the numerous inconveniences which overwhelm the usefulness of the project. For, after all his trouble, and expense of pulling down chimneys and placing them under ground, and besides risking the danger of suffocation from the dry (I cannot say hot or warm) air, ejected into the rooms of his houses with the force of a steam engine, he is scarcely any more secure than with his fire places and stoves, as at present. The idea that candles or lamps would set fire to a building, entirely escaped the vigilent eye of Philo in the formation of his plan, or he certainly would never have neglected to provide a remedy against their effects, when in fact most of our destructive fires are occasioned by them. For my own part, I cannot think that building our 'chimneys' under ground, is the best method of securing the advantage suggested, because the fires which originate from stove-pipes are in consequence of utter carelessness, for who can suppose that a stove-pipe surrounded with dry laths or boards, will not endanger the building in which it is? But yet, absurd as this appears, the greater number of fires arising from stove-pipes may be attributed to this cause alone. Let *us* then, instead of giving advice to founders of cities or towns, recommend to our own citizens, a plan not only superior to Philo's in regard to its practicability and usefulness, but one absolutely necessary, for the security of their houses and property; this is, to allow nothing to come in contact with the stove-pipe that is inflamable, or will conduct the heat; brick or stone is much better than the plate of iron which is commonly used. If this is attended to, and the chimneys built properly, all the security of the plan of Philo will be accomplished without his inconveniences.

Another great object to be gained, according to the ideas which Philo has advanced, is the economy and usefulness of his plan, in the settling of towns and districts. This we will *not* condemn, without as fair an examination of its merits as the case will admit

To begin therefore, we will imagine ourselves ready to adopt the plan proposed by Philo, and commencing operations by endeavoring to find a place for the building in which the air is to be heated But here we are stopped—an unsurmountable difficulty arises, for Philo expressly declares, 'that this establishment must be located near some navigable canal, or good land conveyance,' which according to our experience in settling towns and districts, is the last thing to be found. In the same reasonable strain, he proceeds to the *economy* of his plan; this is the most incomprehensible part of the subject, especially as regards the adoption of such a plan by a city like Boston, for Philo forgets that more land would be required for building a complete house, with a kitchen in the rear; and consequently rents would be raised in proportion, and likewise how many hundreds of families are forced, from their circumstances, to occupy but one room, which is to answer for kitchen, parlor, chamber, &c., and even then with their scanty means, can scarcely obtain a living. How then, I would ask, is this class of persons to be situated? are they to be exposed to all the dangers of fire, and receive no beneficial effects from the economical plan proposed because of their poverty? or is it a fact, that it is intended for the use of the rich, or that class which least require it? If this is the principle of economy which Philo has discovered, he is certainly entitled to a *medal* from a Humane Society, or to have his name *perpetuated* by being engraved upon one of his *chimneys* under ground.

I cannot help pausing with astonishment, at the greatness of the mind, that can conceive of building a town with the same ease that the plan is drawn. For 'ourselves' we should be obliged to get initiated more deeply into the mysteries of fairy-land, and study with more attention the sublime truths contained in the Arabian Tales, before we could 'picture to ourselves,' a New England emigrant going to the west, and amidst the tractless woods and wild prairies, building (instead of a log hut) a commodious house, 'without chimneys'—'locating an establishment near some navigable canal, or good land conveyance, where air may be heated and forced through subterraneous tubes by a *steam engine!*'—or, building his house in one place, kitchen in another, and shop in another, and in the centre, 'a watch tower, with an index which can be swivelled to point out the direction of a fire!' The latter clause is really of more importance, than would be at first supposed; and to impress it on the minds of our readers, I would beg them to recollect the extensive space to be secured, if the above improved plan of building towns and cities, should be adopted, instead of the present *inconvenient* and *dangerous* method.

Although such a task is doubtless a *trifle* to the mind of Philo, who can calculate with *mathematical* accuracy, the centre from which a town would diverge during the existence of time; yet it is no easy matter, for the shallow brains which many of *us* possess to follow *him* through all the ideas which he considers connected with the subject. For this reason, I have no doubt if Philo would

publish the *formula* or *method* by which he can discover the exact spot upon which the 'watch tower' is to be built, that will always remain the centre of a city or town, and what kind of *apparatus* must be used by the watchman stationed in the tower, with which he could see the *inside* of a house when on fire in any quarter of a city, and give the alarm before the flames appeared upon the *outside*, or to distinguish the difference, between the flashing of a torch or lamp at a distance, from a *fire*, he would not only gratify my curiosity, but confer a lasting favor upon the students of *mathematics* and *philosophy* throughout the world. J. M. W.

From the Journal of the Franklin Institute.

METHOD OF TINNING CAST IRON, &c.

GENTLEMEN,—Having frequently tried the following process for *tinning cast iron*, and having found it very easy of execution, and certain in its operation, I am induced to offer it for the benefit of those of your readers who may have occasion to use some process to effect the same purpose. This method is applicable to all sizes of castings.

The surface of the casting is first to be made perfectly clean, by turning or scraping away the outside. Filing does not answer so well as turning or scraping.

Make an amalgam of tin with mercury, containing enough tin to form a soft solid, say of the consistence of butter at 60°.

Prepare a dilute solution of muriatic acid; the muriatic acid of the shops diluted with about an equal weight of water, will give an acid of convenient strength.

Heat the casting until so warm that on a further addition of heat it could not be held conveniently in the hand. Dip a clean linen rag into the dilute acid, and wash with it the surface of the casting where it is to be tinned. Upon another piece of clean linen take up some of the amalgam, and pass it over the surface which has been wet by the acid.

A portion of the amalgam adheres; by rubbing, the tin is precipitated upon the surface of the iron to which it is united, and the face is tinned; after which the article should be immersed in a bath of melted tin and rosin to perfect the coating.

The explanation I take to be this. The diluted acid, aided by heat, acts upon the casting, forming a chloride of iron; when the amalgam is presented to this, the chloride leaves the iron to combine with the mercury, and the iron and tin are precipitated in very intimate union if not in chemical combination. I do not mean to lay particular stress upon this explanation, the steps of the process are detailed just as I have frequently taken them.

It may not be amiss while writing to give an illustration of a method of making available for purposes of art the polish which nature presents in some melted solids. The polish of a clean sur-

face of an alloy of melted tin and lead is very beautiful. Suppose it be desired to fix this upon a tube of copper or iron, as upon the iron spouts attached to tea kettles of tin. The tube is, if of copper, to be prepared in the usual way, and, if of iron, to be well tinned by the method just given, (or any equivalent one.)

Dip the tube into a vessel of a melted alloy, of tin and lead, and allow it to remain until thoroughly heated. On withdrawing the tube the liquid metal runs down the surface. Pour rapidly *into* the tube cold water. The metal will immediately fix upon the outer surface, retaining the polish which it had when liquid.

ISAIAH LUKENS.

From Gill's Technical Repository.

HOW TO TIN NAILS AND TACKS, &c.

First clean the surface of the articles to be tinned from rust or other oxide, by pickling them, or putting them into sulphuric, muriatic, or nitric acid, diluted with water, as usual, and washing them well afterwards in water; then put them into a stone ware gallon bottle, together with a proportionate quantity of bar and grain tin, and of sal-ammoniac: next place this vessel, lying upon its side, over a charcoal fire, made upon a forge-hearth, and keep turning it round, and frequently shaking it, to distribute the tin uniformly over the surfaces of the articles to be tinned; lastly throw the articles into water, to wash away all remains of the sal-ammoniac, and finally dry them in saw-dust made warm. The great merit of the process consists in the employment of the stone-ware vessel, which not only prevents the dissipation of the sal-ammoniac in fumes, but also gives up the whole of the tin to the articles to be tinned, which would not be the case were a metallic vessel to be used.

From a Manchester Paper.

STEAM-BOILER EXPLOSION.

ON Thursday, the 22nd of March, the extensive calender house of Messrs. Goodier & Co. of Manchester, was almost entirely demolished by the explosion of a steam-boiler; five persons killed, and many others severely wounded. On the forenoon of that day, the engineer discovered that the eccentric motion which worked the steam-valves had sustained some injury; a millwright was set to repair it; but as it was expected the repair would be completed in the course of the afternoon, moderate fires were kept under the boilers, and the steam kept up. The works were driven principally by an engine of 32-horse power, not a high pressure one, but a condensing engine of the best kind, made by Boulton & Watt; and it was worked at a pressure never exceeding 12 lbs. on the square inch. It was supplied with steam from two twenty horse boilers, which were placed side by side transversely across the cellar of

the building. The safety valve is stated to have been five inches in diameter, and to have been loaded with 224 lbs. being about ten pounds to the square inch. But it seems there were no safety valves on the boilers themselves, but one upon a large pipe which conveyed the steam to the cylinder. Between that pipe and the boiler were stop cocks, so that each boiler could at pleasure be shut off from the pipe. It is supposed that one or both of the boilers had been thus shut off, for the conveniences of making the repairs. If so, the steam could not act upon the safety valve, and the pressure becoming too great, an explosion was the necessary consequence. In 1828, an explosion took place from this very cause at the factory of Mr. Thomas Kearsley, at Tryldesley, by which ten persons were killed, and great part of a new and extensive building demolished.

ANSWER.

In answer to Joseph in our last number, we would say, that the small wheel would revolve 127 times, and the large one 21 times, before the same two cogs would meet again.

The following rules are taken from Evan's Millwright's Guide, and may be of service to our readers. EDS.

1. Divide the cogs in the greater wheel by the cogs in the lesser; and if there be no remainder, the same cogs will meet once every revolution of the great wheel.

2. If there be a remainder, divide the cogs in the lesser wheel by the said remainder; and if it divide them equally, the quotient shows how often the great wheel will revolve before the same cogs meet.

3. But if it will not divide equally, then the great wheel will revolve as often as there are cogs in the small wheel, and the small wheel as often as there are cogs in the large wheel, before the same cogs meet: oftener they can never be made to change.

QUESTION.

Meeting with the following question not long since, my curiosity was excited by its singularity and though I have tried to solve it several times I have not been able to get the precise answer. The answer I obtained gives one mill and a fraction too much. Some other persons have also been unable to solve it; among them are two teachers of schools. If any of your correspondents will give the precise amount of each man's share they will oblige A SUBSCRIBER.

Three men were employed to draw a load of plaster from Boston to Windsor for $26 45, each man having one horse. A and B's horses are supposed to do 3-4 of the work, A and C's 9-10 and B and C's 13-20. They are to be paid proportionally. What is each man's share of the money? B.